

LIBRARY
NEW YORK
BOTANICAL
GARDEN

THE

GARDENS' BULLETIN, STRAITS SETTLEMENTS.

Vol. II.

Issued January, 31st 1920.

No. 6.

Mr. Lawrence Niven.

Mr. Lawrence Niven commenced work at the Botanical Gardens almost as soon as they were opened by the "Singapore Agri-horticultural Society," which was formed in 1859. The Gardens were developed in 1861-62 and after successful shows in the former year, it is recorded that "The Society had obtained the part time services of Mr. Lawrence Niven as Superintendent." Mr. Niven was also superintendent of an adjoining nutmeg plantation, so that he could combine the two very well. He earned the thanks of the Committee for "his taste in laying out the Gardens," and Mr. Buckley records that he made the Gardens very attractive by large beds of pretty flowers. He is also mentioned with praise in the Gardens Guide published in 1889. The title of his office, which was more honorary than remunerative, was changed in 1874 to Manager, the Government then taking over the Gardens. Mr. Niven retained charge until the arrival of Mr. James Murton in 1875.

W. MAKEPEACE.

A Guide to the Palm Collection in the Botanic Gardens, Singapore.

But two brief notes have so far been published on the fine collection of Palms growing in the Botanic Gardens, Singapore. The first in the "Agricultural Bulletin, S. and F. M. S." (Vol. III, p. 249) in 1904, the second in the same Journal (Vol. V, p. 6) in 1906, both presumably by Mr. Ridley. In the fourteen years since the last article was written many additions, and it is feared several losses, have to be recorded and accordingly it seemed desirable thoroughly to investigate the collection again. The present paper is the outcome of this work.

In the first paper of Mr. Ridley, entitled "The Palm Collection of the Botanic Gardens, Singapore," the cultivation and pests of the palms has been rather fully treated, and a list of the palms

MAR 24 1920

in cultivation in the Gardens is appended. In the second paper is a list of new palms introduced into the collection since the publication of the earlier paper.

The present paper is written with the object of drawing attention to the collection and in providing a guide and brief description for visitors to the Gardens, who are interested in Palms. It has been written in a semipopular style accordingly and botanical terminology, synonymy, and citations of other works are given as sparingly as possible. A short description of the collection is first given with a general comparison of the prominent features of the palms. This is followed by a list of the genera represented and a brief note on each species, sufficient to enable them to be determined at sight.

Only those species whose identity has been established either from actual determination or from previous records as found on the labels have been mentioned. There are still several not yet named, many of them quite young, but until they produce flowers and fruit it is impossible to determine them accurately and they have accordingly been omitted.

The collection of palms is quite a representative one, including species from most tropical countries. No special arrangement, except in one or two instances, has been followed in planting and the result is by no means displeasing. A fairly large piece of ground near the Gardens Office, has been exclusively planted up with palms, and from the lower end of Maranta Avenue down to the Plant Nursery there extends what is known as the Palm Valley, and as the name implies, the valley has been reserved almost entirely for palm specimens. On the west side, several species have been quite successfully planted in clumps, notably—*Ptychosperma McArthurii*, Wendl., *Cyrtostachys Lakka*, Becc., *Martinezia caryotaefolia*, H. B. K., *Pinanga Kuhlii*, Bl., *Rhopaloblaste hexandra*, Scheff., *Oncosperma filamentosa*, Bl., *Heterospatha elata*, Scheff., *Oreodoxa regia*, H. B. K., *Stevensonia grandifolia*, Dume., *Verschaffeltia splendida*, Wendl., *Ptychoraphis angusta*, Becc.

Apart from these two special places, many specimens are scattered over the remainder of the Gardens. Small avenues have been planted in one or two places, as for example, the avenue of *Arenga saccharifera*, Labill., near the Tyersall Road entrance. There is also an avenue of *Sabal Palmello*, Lodd., another not quite complete of *Rhopaloblaste hexandra*, Scheff., interplanted with *Phoenix rupicola*, Anders. This latter gives quite a pleasing effect, the tall *Rhopaloblaste hexandra* with its drooping leaflets, and the beautiful curved leaves of *Phoenix rupicola*, make a very pretty picture. Another avenue which must be mentioned, is of *Cyrtostachys Lakka*, Becc., the "Pinaug Rajah," "Sealing Wax Palm," or "Red-stemmed Palm." This avenue contains five specimens of this beautiful palm, so distinct from all others on account of what appears to be a red stem, but is actually the red sheathing bases of the leaves. The remaining plants have either

been planted in rows of single species, or more generally as isolated plants with a view to their developing into worthy representatives of their species. On the whole this latter ideal has been attained and a few very fine specimens might be mentioned such as, *Attalea Cohune*, Mart., near the lake, *Corypha Gebanga*, Bl., near the Herbarium, a young plant of *Latania Commersonii*, L., near the Office, and two very tall specimens of *Livistona altissima*, Zoll., on the Bandstand Hill, and many specimens of *Oncosperma filamentosum*, Bl. (Nibong) and *Elaeis guineensis*, Jacq. Altogether there are about 1085 specimens planted in the Gardens embracing upwards of 120 species and 60 genera.

A COMPARISON OF GENERAL CHARACTERS.

The variation in growth of the palms allows them to be grouped under three heads:—

- (1) Those which are soboliferous, that is whose stems grow in clumps such as *Caryota mitis*, Lour., *Cyrtostachys Lakka*, Becc., *Oncosperma filamentosum*, Bl.
- (2) Those which are soboliferous but are not self-supporting, obtaining their support from surrounding trees. This section includes the many species of *Calamus*, *Korthalsia* and *Dacmonorops*, and amongst which are many plants of considerable economic importance. Some grow to a great height, topping the highest of our jungle trees. Examples may be seen in the piece of virgin jungle preserved in the gardens, especially at the top end of Maranta Avenue.
- (3) Those palms which are single-stemmed, bearing in some cases a magnificent crown of leaves as in *Corypha*, or in other cases a comparatively small one as in the tall *Livistonas*, and *Archontophoenix Alexandra*, Wendl.

A DESCRIPTION OF PALMS IN GENERAL.

Root. Generally speaking palms have no tap-roots. After germination the primary root perishes and is replaced by adventitious roots springing from the base of the stem. In *Verschaffeltia splendida*, Wendl., roots are produced up to 2 or 3 ft., and even more above the surface of the ground. These grow downwards and finally become fixed in the soil giving the plant a firm footing. In others such as *Rhapis*, and *Pinanga*, suckers are produced which send up stems and leaves, soon forming fine clumps.

STEM. The height or length of the stem varies considerably and in some cases there is hardly any stem at all as in *Sabal acaulis*. In others however, they may be of any height or length, some specimens of *Calamus* being as much as 300 ft. Except for the last mentioned, no specimen in the Gardens exceeds 80 ft., this height being attained by two specimens of *Livistona altissima*, Zoll., on the Bandstand Hill. As a general rule single-stemmed palms attain to a greater height than soboliferous or several-stemmed palms. In diameter stems vary considerably, from 1-2 inches

in the slender *Calamus*, *Ptychosperma*, etc., to the very substantial looking trunks of *Oreodora*, *Metroxylon*, *Borassus*, and *Corypha*, which in some specimens are anything from 3-5 feet.

In *Oreodora regia*, H. B. K., the trunk is quite smooth, while in *Archontophoenix Alexandrac*, Wendl., it is ringed by the scars of the old leaves. Other species such as *Attalea Cohune*, Mart., and *Elæis guineensis*, Jacq., retain the bases of the old leaves which gives them a rugged appearance. Ferns and orchids often obtain a footing in these leaf bases presenting a typically tropical effect. In *Caryota urens*, L., the sheathing bases remain round the stem after the leaves have fallen and are bound together with a dense mass of fibres. Yet other palms have spiny trunks as for example, *Oncosperma horrida*, Scheff., and *O. fasciculata*, Thw.

Very few of the palms have branched trunks. One species *Hyphaene indica*, Becc., is represented in the gardens, but the plants are quite small and are only about six months old.

The Rattans (*Calamus*, etc.) are almost the only palms whose stems are not self-supporting.

LEAF. As new leaves are produced the old leaves generally die off and fall away. By this means in most cases a fine trunk is produced, surmounted by a magnificent crown of leaves. It is this crown of leaves which gives such a distinctive beauty to palms in general. They vary considerably in size, from the small-leaved *Rhapis flabelliformis*, L'Herit., to the gigantic leaved *Teymannia altifrons*, Miq.

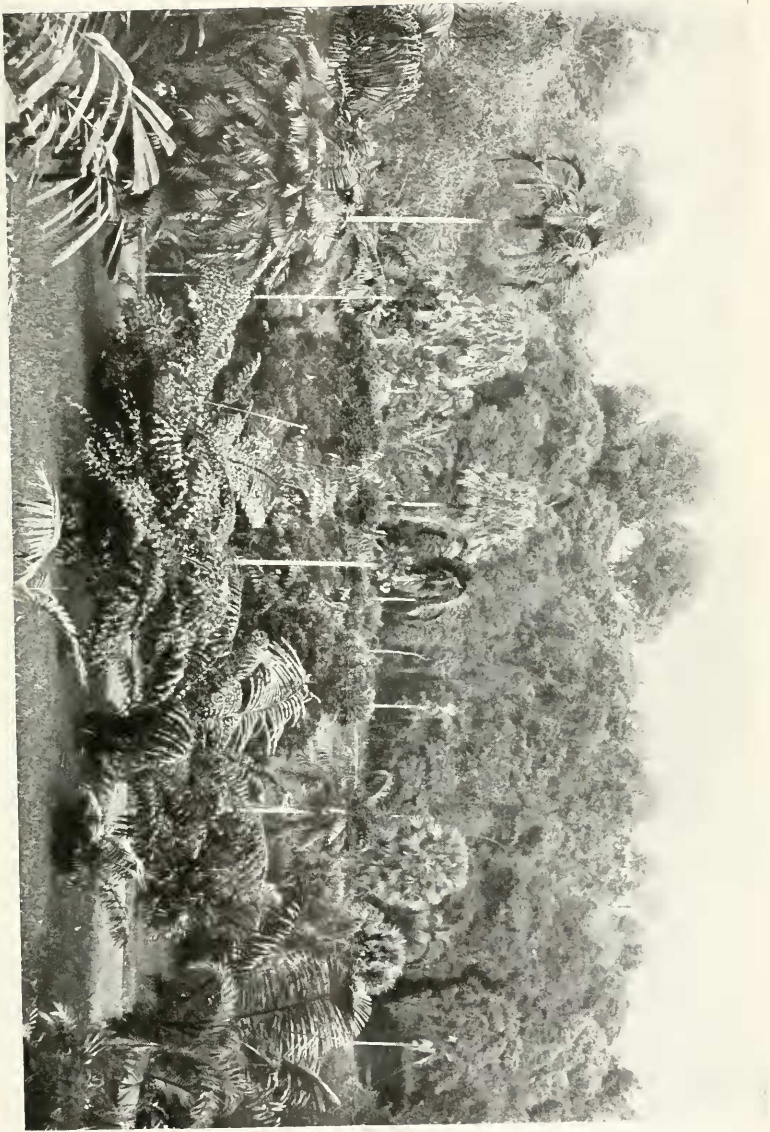
The variation in the shape of the leaf is considerable, but may be considered under two heads:—

- (1) Palmate, in which the leaves are characteristically fan-shaped and
- (2) Pinnate, in which the leaves are cut similar to a feather.

Examples of the first are *Livistona*, and *Thrinax*, of the latter *Ptychosperma*, *Cyrtostachys*, and *Oncosperma*.

Feather leaved palms have on the whole very much larger leaves than fan palms. The length of some of them being as much as 30 ft., and their width 8 ft. However, none quite so large are to be seen at present in the Gardens. The angle which the leaf makes with the stem varies according to the age of the leaf. At first when opening, a leaf is almost upright, but as it develops its weight bends it down and the falling away of the lower leaves causes it to hang lower until it in its turn dies and falls away. The leaves of fan palms as a rule form a larger angle with the stem than those of the feather palms. The reason being, that the weight is less evenly distributed, being placed at the end of the petiole, instead of almost the whole length of the leaf as in the latter.

Considerable variation is found in the leaflets. In the pinnate section their relative positions on the leaf-rachis give a distinctive appearance to many species. A few examples in both sections will emphasize this. In the palmate section, one finds in *Pritchardia*



In the Palm valley, Singapore.

grandis. Seem., that the whole of the leaflets seem to be joined up to form one deeply furrowed leaf, having a very strongly-toothed margin. Other species of the same genus *L. peltata*, Roxb., for example are divided almost to the base, producing furrowed leaflets which are very broad and strongly toothed at the apex, narrowing to the base, giving them almost a triangular shape. Good examples of fan-leaves are found in *Thrinax* and *Livistona* in which they are divided from $\frac{1}{4}$ to $\frac{1}{2}$ the length of the leaf. This is the general type of fan-palm.

In the pinnate section the angle which the leaflet forms with the leaf-rachis varies considerably. For instance in *Archontophoenix*, and *Cyrtostachys*, the leaflet is placed more or less at right angles to the rachis forming a fairly flat-leaf. On the other hand in *Rhopaloblaste* and *Oncosperma*, the angle is much greater giving a drooping appearance which is very attractive. The leaflets are generally arranged in two rows one each side the rachis, and as they are more or less opposite, they produce a flat leaf. This is the general arrangement for pinnate-leaved palms. A departure from this method is found in some species, as for instance in *Raphia Hookeri*, M. and W.. Here the leaflets appear to be arranged in four rows, two each side of the rachis. This is due to their being placed at different angles. The two bottom rows, one each side of the rachis, consist of alternate twos or threes placed at the usual angle, while the two upper rows, are the remaining leaflets placed at a very much more acute angle, thus giving the appearance of four rows, whereas in reality there are but two. This arrangement gives a very different appearance to this type of palm, and one fine specimen in the gardens makes a noble-looking plant. Another very distinctive form is that of *Caryota urens*, L. In this species the leaves are bipinnate or decompound, quite an unusual form in the palm-family. In fact this plant appears more like a gigantic tree-fern. One other genus should be mentioned, namely, *Martinezia* from America. In *M. caryotaefolia*, H. B. K., the leaflets, which are of peculiar shape, are placed at intervals in threes and fours on the rachis, the spaces between being clothed with very sharp spines.

The petioles of several species are armed with spines. When allied with spiny stems they form a very formidable barrier in the jungle. Mention has been made of the spiny leaf-rachis of *Martinezia*, this plant has also a very spiny stem. The same combination is found in *Oncosperma horrida*, Scheff., though the leaf-rachis of this species is not so spiny as that of *Martinezia*. Many palms have spines on the petiole only, such as *Livistona*, and *Elæis*.

The stems and leaves of *Calamus*, and *Korthalsia*, are generally provided with numerous recurved spines, and the leaf rachis is often produced into a barbed, whip-like structure. These spines which are reflexed enable the plants to climb over the surrounding shrubs and to the tops of the highest trees.

The many different positions assumed by the leaves are often taken up to protect the plants from the effects of too intensive

sunlight and the violence of wind and rain. This arrangement adds very much in some cases to the beauty of the plant. *Phoenix rupicola*, Anders., affords an excellent example. The curve affected by the leaves of this plant renders it more beautiful than would be the case were the leaves straight.

FLOWERS. These are produced in large numbers on large and much-branched inflorescences. They are frequently embedded in the fleshy surface of the branches, and belong to a type of inflorescence known as a spadix. In almost all palms the inflorescences are axillary, only in one or two cases are they produced terminally, as in *Metroxylon*, and *Corypha*. Each inflorescence when in bud, is enclosed in a protective structure called a spathe. This is burst by the growing inflorescence and falls off at once, or sometimes remains to sheathe the stalk and lower branches. The flowers are very small and individually insignificant, but are produced in enormous quantities, thousands often being borne on one inflorescence. Collectively they often present a handsome appearance. They are sessile, and as a rule unisexual, the male and female occupying different parts of the same inflorescence. Very rarely hermaphrodite flowers are produced. In some cases female flowers are borne on the lower branches of the spadix with the male flowers densely packed on the upper. In others as for example in *Pinanga* the female flowers are placed between the male flowers and it is so arranged that two male flowers appear in succession and then the female, thereby making the spike unisexual for the time being. As palms are monocotyledonous plants the general arrangement of the flower is trimerous, that is 3 sepals, 3 petals, 6, or a multiple, stamens, and 3 carpels. In the male flowers the carpels are rudimentary and are called pistillodes and in the female flowers the stamens are rudimentary and are termed staminodes. Pollen is produced in great quantities and probably wind is one of the chief agents in pollination. Bees also play an important part in this matter. Also the writer has seen flower spikes literally swarming with a large type of ant and it seems probable that pollination might be carried out by them. The ovary generally consists of three carpels either quite free or completely united.

FRUIT. The fruit is either a berry or a drupe. Two of the carpels may be abortive as in the Coconut, or if the carpels are free, a syncarp of one-seeded fruits results, or again if united, a single fruit with one, two or three seeds, according to the number of ovules which develop is the result. The fruits are on the whole small when compared with the size of the plant, that of the Coconut being one of the largest. This is, however, quite dwarfed by the huge fruit of the Double Coconut (*Lodoicea sechellarum*, Labill.), from the Seychelles.

SEEDS. The seeds are of various shapes and sizes. They are round in the Coconut, owing to one ovule only as a rule having developed, whilst in the Date, (*Phoenix dactylifera*, L.), they are long and narrow. Where three seeds are produced two sides are often flattened.

CULTIVATION. A few notes on the general cultivation and propagation of palms in the tropics would it is thought be of use. This has been fully dealt with in "The Agricultural Bulletin S. and F. M. S.," Vol. III, page 250. The following extract is taken from that journal as the notes there given are equally applicable now.

"Although far the greater number of palms are natives of tropical regions a small number inhabit cooler, sub-tropical, or almost temperate regions. Such are *Chamaerops humilis* of Southern Europe, *Nannorhops Ritchiana* of Afghanistan, *Trachycarpus excelsus* of Japan, *Rhapis humilis* of Japan, *Kentia sapida* of New Zealand, and *Pseudophoenix Sargentii* of Florida.

"These cooler climate palms are much less easy to cultivate here and seldom thrive when planted out, although they may be kept as pot or tub plants for a long time.

"There are also a few desert palms, which are also difficult to grow on account of our heavy rainfall, such are *Hyphaenes*, the common date, (*Phoenix dactylifera*), which, however, can be made to grow but has never flowered with us. The Palmyra or Lontar palm (*Borassus*) introduced to India from Africa and thence to the Peninsula, thrives near the sea in sandy places, but seems difficult to grow far inland, and even in the drier parts of Singapore is not at all easy to grow satisfactorily. The Nipa palm so abundant in the tidal swamps does not grow well away from salt mud.

"Exclusive of these almost all the palms from different parts of the world which have been introduced into Singapore have done well and many have flowered and fruited successfully and are readily cultivated.

"**SEEDS.** Generally speaking palms are reproduced from seeds, in a few instances propagation by means of division or root cuttings is the method adopted. The principal genera from which root cuttings may be obtained are:—*Pinanga*, *Cyrtostachys*, *Oncosperma*, *Iriarteia*, *Oenocarpus*, *Chamaedorea*, *Chrysalidocarpus*, *Wallichia*, *Arenga*, *Caryota*, *Nipa*, *Licuala*, *Rhapis*, *Calamus*, *Zalacca*, *Korthalsia*, *Raphia*, *Bactris*, *Desmorcus*, *Astrocaryum*, and *Sagus*. With these an underground creeping rhizome produces a new growth and it is best to cut or ring this rhizome behind the growth and when a tuft of roots has been formed the cutting may be removed. Root cuttings, however, seldom make nice shapely plants, the process is usually a slow one and the percentage of loss generally heavy, for these reasons when procurable seeds are always preferred.

"In collecting palm seeds it is essential that the seed should be perfectly ripe. This is generally easily determined by the hardness of the seed, that is to say of the albumen, and also by the colour and softness of the fruit, occasionally the albumen seems to be fairly hard before the fruit is ripe enough to germinate. The colour of the fruit is often a help, thus, in *Iguanura* the fruit is first white, then becomes red, and at last black, and when it has arrived at this colour only it is ripe enough for collecting.

" The fruits of palms may be fleshy, fibrous or even woody, and a few have a spiny spathe which has to be guarded against. Fleshy fruits soon ferment and the pulp is easily removed. Fibrous fruits may be macerated for a day or two when the outer covering can be split or peeled off. The Malayan "Kabong" is one of the worst to handle, the juice from the fruits being a skin poison. The Kitool (*Caryota urens*) is also a powerful irritant on the skin. Many palms germinate freely when left to themselves, under cultivation however it is best to remove the outer covering of the seed because of the decay of the pulp or fibrous covering and possible loss from fungus. The period of germination varies from 6 weeks with some to 3 or 4 years with others. Excepting, those palms requiring much space, Coconuts, Sago, it is best to plant seeds in pots or boxes, whichever is used the drainage should be deep and well covered with half decayed leaves to prevent the compost from blocking up the drainage. The compost to be used should be free from fungi and consist of burnt earth, well decayed leaf-mould, some sand, and a little powdered charcoal. Seeds may be planted fairly close, small seeds placed upright, large seeds on one side, or flat, and covered with one-half to one inch of the prepared compost which has been passed through a sieve of a fine mesh. After planting the pots or boxes should be thoroughly watered (saturated) placed in a moderately damp situation and afterwards sufficiently sprinkled so as never to be over wet or too dry. Palm seeds when planted must be guarded from rats and mice, and white ants, the surface soil inspected, and excessive damp and fungus removed. The growth is often at first very slow (this is especially noticeable in rattans) but after a year or two the growth increases much more rapidly.

" SEEDLINGS. With most of the best known palms seedlings may be described as fairly hardy and only ordinary attention is necessary to produce strong plants, most failures occur through excessive damp or watering, and the moisture remaining in the axils of the leaves, or because the surface soil is too damp in which case the seedling perishes. A few species of palms have been introduced to cultivation by seedlings collected in the jungle of which seeds have not been procurable. Owing to the different conditions under which such seedlings have germinated care must be taken to wrap the roots in mud immediately on lifting them and the seedlings dug up with a good ball of earth attached to them. The little plants must be kept very moist till they can be planted, and not allowed to get dry by exposure to the sun or they speedily perish. Some jungle palms stand transport fairly well, especially rattans and with some species it is the only way to get them.

" RE-POTTING. As soon as seedling palms have filled their pots with roots, the young plants should be transplanted or repotted into single pots and a strong compost used. Some loamy soil, well decayed cow manure and leaf-mould, some sand and burnt earth, all well mixed together and passed through a moderately coarse sieve. Let the drainage be sufficient and placed carefully. All loose